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but further investigation showed it to have become changed into that peculiar substance known as adipocere. Adipocere (*adeps*, 'fat,' and *cera*, 'wax') has somewhat the appearance and consistence of cheese, and is a compound of oleic and margaric acids with an alkali. It has usually been formed in bodies that are buried in the earth, and moisture has been supposed to be essential in its formation. In the instance just referred to, the body was in a dry vault. There seems to be no fixed time necessary for this change to take place. One instance is reported of an infant which had been but three months in a cesspool, in which adipocere had formed, while in other cases years seem to have been necessary.

#### LETTERS TO THE EDITOR.

\*.\*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

#### National prosperity.

IN Mr. Atkinson's paper in the January *Century* there are some uses made of statistics which seem to a layman at least a little queer.

He gives us a table of enormous percentages to show how greatly the United States have increased in productiveness and wealth.

Since 1865 we are told the yield of hay has increased 106 per cent; of cotton, 194 per cent; of grain, i.e., wheat, corn, oats, barley, rye, and buckwheat, 256 per cent; railway mileage, 280 per cent; insurance against fire, 310 per cent; output of pig-iron, 386 per cent; and population, 69 per cent. The ratios are seemingly wonderful, but in some cases very deceptive, most so in cotton. In 1865 the number of bales was 2,228,951, and in 1885, 6,550,215, a gain in twenty years of 194 per cent. Will it be surprising to be told that the gain is not 194 per cent, but only 22 per cent? Here it is.

In 1860 the number of bales recorded was 5,387,052, on which the gain in 1885 is but 22 per cent. Why does the statistician take the phenomenally low year of 1865, which was behind 1850 even? We have merely regained the position of 1860, and advanced 22 per cent.

And as to increase, the gain from 1850 to 1860 with slave-labor was 118 per cent, in ten years, — an average of  $11\frac{8}{10}$  per cent per year, which, compared with the free-labor rate,  $9\frac{7}{10}$  per cent per year, shows that the increased production under free labor is somewhat of a myth. At the slave-labor rate of increase, the twenty years from 1865 to 1885 would have culminated in a crop of 7,489,275 bales. In what, pray, does the superiority of free labor make itself manifest?

Population, we are told, has increased 69 per cent since 1865; from 1860 to 1870 the increase was 23 per cent,  $2\frac{3}{10}$  per cent per year; from 1870 to 1880 it was 30 per cent, or 3 per cent per year; from 1880 to 1885 we find a gain of 14 per cent, or  $2\frac{4}{5}$  per cent per year.

Now, from 1850 to 1860 the increase was 36 per cent, or  $3\frac{6}{10}$  per cent per year, a higher rate than that of any decade since then. Had we increased from 1865 to 1885 at the rate of the decade before the war, we should now number over 61,000,000 instead of 56,975,000.

256 per cent, we are told, has our grain-crop increased from 1865 to 1885. The grain-crop of 1865 was over 100,000,000 bushels less than that of 1860. By decades we find that the increase between the years 1860 and 1870 was 32 per cent; 1870 to 1880, 50 per cent; and from 1880 to 1885, 23 per cent, or  $3\frac{2}{10}$  per cent, 5 per cent, and  $4\frac{8}{10}$  per cent per year respectively. The gain from 1850 to 1860 was 43 per cent, or  $4\frac{3}{10}$  per cent per year; and if we calculate from 1860 to 1885 at the same rate, 43 per cent per decade, we find due us a crop of 3,060,428,664 bushels as against 3,014,063,984; and the marvellous gain of 256 per cent over 1865 appears less than was to be expected from what we were doing before the war. The hay-crop of 1882 would have amounted to about 600,000 tons more, if it had been the result of an increase as from 1850 to 1860. Since 1882 the hay-crop jumped from 38,000,000 tons to 48,000,000 in two years, a truly phenomenal increase.

Railway mileage has increased 280 per cent since 1865; but, if we are to talk of per cents, let this gain of twenty years be compared with 217 per cent, ten years' gain from 1850 to 1860. In miles the gain has been from 1850 to 1860, 21,500; 1860 to 1870, 22,400; 1870 to 1880, 40,700; 1880 to 1885, 32,000.

It would be of interest to see if the net income has increased *pro rata*.

For progress in wealth we are shown a table of fire-insurance risks, and an increase therein of 310 per cent since 1865. Why not take the assessed value of all real and personal property? This was, in 1850, \$7,000,000,000; in 1860, \$13,000,000,000; and in 1880, \$17,000,000,000. Of course, there is an increase since 1865, but in per cent it does not compare with that from 1850 to 1860.

As to pig-iron and its 386 per cent increase since 1865, it will take a pretty stiff-necked protectionist to understand how, under the conditions of its production, it stands for 386 per cent increase of wealth to the people who have to use it and pay for it.

And now, if, to make the showing a little more comprehensive, we look at the number of acres of improved land, we find that it increased 44 per cent from 1850 to 1860, 16 per cent from 1860 to 1870, and fifty per cent from 1870 to 1880, — an average of  $3\frac{2}{3}$  per cent per year, — very close to the increase in population. The value of agricultural implements increases, from 1850 to 1860, 62 per cent; 1860 to 1870, 37 per cent; 1870 to 1880, 2 per cent; annual average, 4 per cent.

Rice production has fallen from 215,000,000 pounds in 1850 to 110,000,000 in 1880. Tobacco, which gave an increase of 117 per cent from 1850 to 1860, and in 1860 had 434,000,000 pounds, has but 472,000,000 in 1880.

Irish potatoes increase 69 per cent, 29 per cent, 18 per cent, respectively for the three decades, or the average of  $3\frac{8}{10}$  per cent per year.

Sweet-potatoes fall from 38,000,000 bushels in 1850 to 33,000,000 in 1880. Cheese, also, which was at 105,000,000 pounds in 1850, is in 1880 only 27,000,000 pounds. Butter rises 46 per cent, 12 per cent, and 21 per cent through the three decades, an average of 2.6 per cent per year. Live-stock gains 100 per cent from 1850 to 1860, 40 per cent from 1860 to 1870, and falls off 6 per cent between 1870 and 1880, an average rate of increase of  $4\frac{2}{3}$  per cent.

And while our public debt has been decreased by \$876,970,833 between 1865 and 1880, we find on hand in 1880 a state, county, and town debt of

\$1,056,406,208, which seems to show that the revenue which went to reduce the national debt has been diverted to local improvements, and has become a wealth-producing power.

Comparing, now, the average increase by decades since 1850, we find population at about 30 per cent per decade; hay, except for 1883 and 1884, 36 per cent; cotton, 40 per cent; grain, 42 per cent; railway mileage, 115 per cent; improved land, 37 per cent; agricultural implements, 40 per cent; Irish potatoes, 38 per cent; butter, 26 per cent; live-stock, 47 per cent; assessed valuation, 40 per cent; while rice, sweet-potatoes, and cheese have decreased 50 per cent, 14 per cent, 74 per cent, tobacco is as in 1860, and our debts have simply changed form. This statement of average increases per decade shows how closely together the various values have kept for thirty-five years. The great advance since 1865 has now about brought us up to the place we should expect had the war not interrupted our development. Production has advanced only a little faster than population, and this is probably due to improved implements, improved methods, greater demand, and more facilities for handling the crops, i.e., railways.

C. H. LEETE.

New York, Jan. 22.

#### Professor Newberry on earthquakes.

In his notice of my article on earthquakes, in *Science* of Jan. 7, Mr. Everett Hayden intimates that I am not warranted in my statements in reference to the cause of earthquakes and the condition of the interior of the earth, citing the diversity of opinion which is on record, and the authority of great names opposed to me, as a reason why I should exhibit greater modesty.

I am sorry that I cannot see the matter from Mr. Hayden's stand-point. If he has any facts or arguments to offer which militate against the statements I have made, I shall be most happy to consider them, and I shall be convinced by them if they are convincing; but, without facts or new arguments, we may well be spared the appeal to authority. A blind deference to the utterances of great men has done geology much harm. Sir William Thomson has no more sincere admirer than myself, both for his genius and his nobility of character; and yet I do not hesitate to say, that by his unwarranted statements in regard to the condition of the interior of the earth, a matter in which his mathematical genius and learning give him no fitness to speak authoritatively, he has seriously retarded the progress of geological knowledge. From the phenomena of the tides and the precession of the equinoxes, he has inferred and asserted that the figure of the earth is as inflexible as though it were composed of glass or steel. There is, however, a doubt in the minds of many physicists whether the tides and the precession of the equinoxes afford such delicate and quantitative tests of the constancy of the earth's figure as to warrant these conclusions. Hennesy and Delaunay have shown that the argument from the precession of the equinoxes, at least, is weak; but, even if the fact of the constancy of the earth's figure be conceded, the inference that it is because of a rigidity of the earth's material equal to that of glass or steel, is certainly unwarranted. The argument proves too much: we all know that the materials composing the earth's

mass are *not* as rigid as steel. The facts connected with earthquakes, volcanoes, mountain-chains, and the oscillations of the level of coasts, which I briefly cited in my article, show conclusively that the earth is not an unyielding solid; and I have suggested that the want of homogeneity in the materials composing it, — partly solid, partly viscous, partly fluid, — under varying conditions of pressure, may neutralize the tendency to distortion from the changing attractions of the sun and moon. The facts cited by geologists as disproving the absolute rigidity of the earth are unquestionable, and their arguments are cumulative and unanswerable. Hence astronomers must find some other explanation of the constancy of the figure of the earth — if that be proved — than a solid interior.

I am only exercising my inalienable right, am defending my hearth and home, when I protest against the invasion of our field of research by masters in other departments of science, however gifted, who, with imperfect knowledge, hurry to conclusions incompatible with those which geologists have reached by lifelong study. That Sir William Thomson did not give to the geological facts due consideration when he uttered his dictum, is shown in his original paper read before the Geological society of Glasgow in 1879. Here in advocating the theory that the earth is solid, and that the solidification began at the centre, the result of the cooling and sinking of an external crust, he states that most substances are denser when cooled to solidification than when fused. In a footnote to p. 40 of the volume of the Transactions of the geological society of Glasgow which contains Sir William Thomson's address, is given a report of later experiments made to test this question by Mr. Joseph Whitley of Leeds, England, who found that iron, copper, brass, whinstone, and granite, the only materials he tested, were all less dense when solid than liquid.

This is not the only instance where men of deserved eminence in their own departments of science, without taking pains to inform themselves in regard to the facts of geology, have sought to teach geologists lessons which they have not themselves fully learned.

Sir Robert Ball, astronomer royal of Ireland, an able and distinguished man, whose merits have been suitably recognized in the office he holds, and the title conferred upon him, in his eloquent address entitled 'Glimpses through the corridors of time,' has proposed a theory, which, if accepted, would not only revolutionize all geological history, but would discredit the teachings of the most eminent geologists. In the circumstances, I have felt called upon to protest against this invasion of our domain, and have shown that the geological record affords conclusive evidence against this theory.

So Mendelieff, one of the most eminent of chemists, has proclaimed the inorganic origin of the Pennsylvania petroleum from an inferred absence of organic matter from which it could be generated. Here, also, I have ventured to show that a better knowledge of the geological structure of western Pennsylvania would have revealed to him the true source of the petroleum in enormous underlying organic deposits, and would have prevented the promulgation of a geological heresy.

Those only are capable of intelligently discussing and deciding these difficult problems in geology, who, with special tastes and abilities, have devoted lives